STATEMENT OF BASIS and FACT SHEET
BNSF RAILWAY
PARADISE TIE TREATING PLANT SITE
PARADISE, MONTANA

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
March 22, 2006

OPPORTUNITY FOR PUBLIC INVOLVEMENT

DEQ Announces Proposed Decision for Control of Contaminated Groundwater at the Paradise Tie Treating Plant

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DECISION SUMMARY

The Montana Department of Environmental Quality (MDEQ) has prepared this Statement of Basis (SB) to describe a proposed remedy for groundwater contamination at the BNSF Railway Company (BNSF) former tie treating plant in Paradise, Montana (Paradise Site). The SB identifies the proposed remedy for contaminated groundwater and explains the rationale for selection. In addition, the document briefly describes all other remedies considered during the remedy evaluation process. MDEQ proposes to select a remedy for groundwater contamination that will include source control via pump-and-treat technology, monitored natural attenuation supported by an Alternate Concentration Limit (ACL), and land use controls. Requirements for the selected remedy are included in the proposed modification of BNSF's hazardous waste permit.

MDEQ is soliciting public comment on the remedy and modified BNSF hazardous waste permit (MTHWP-01-02) during a public comment period, (March 22 through May 5, 2006). During the public comment period, any interested person may request a public hearing. A request for a public hearing must be in writing and must state the nature of the issues proposed to be raised in the hearing. If a hearing is held, the DEQ will provide notice of the public hearing date at least thirty days prior to the hearing.

MDEQ is issuing this SB as a part of its public participation requirements under the Montana Hazardous Waste Act (MHWA). In addition, this document includes the fact sheet requirements in 40 Code of Federal Regulations (CFR) 124.8 as incorporated by reference in the Administrative Rules of Montana (ARM), Title, 17, Chapter 53, Subchapters 1 through 14.

1.0 LOCATION AND CURRENT USE

The Paradise Site is located approximately three-quarters of a mile northwest of the town of Paradise and five miles south of the town of Plains. Paradise is the only population center within five miles. The site is south of Highway 200, on the northern bank of the Clark Fork River. BNSF and its predecessors owned the property between the river and the primary railroad tracks at the time of tie treating operations. The following areas of the site are currently regulated by a hazardous waste permit issued by MDEQ: an active Corrective Action Management Unit (CAMU) which includes a product recovery system and active land treatment unit (LTU), a closed surface impoundment, and a closed waste pile unit.

2.0 BACKGROUND

2.1 Operation

The Paradise Site tie treating plant operated from 1908 to 1982. Creosote was the only wood preservative known to have been used at the plant. Creosote is produced from coal tar and is a mixture of hundreds of compounds, primarily semi-volatile organic compounds. Polynuclear aromatic hydrocarbons (PAHs) are semi-volatile organic compounds that generally account for 85 percent (by weight) of creosote.

Railroad ties were treated with creosote at elevated pressures and temperatures in the treatment building. Wastewater from the plant was discharged through a buried pipe into a surface impoundment located southwest of the plant site. The impoundment is a former channel of the Clark Fork River and was used during plant operations as a settling basin for recovery and reuse of creosote.

Freshly treated ties were transported to the drip track area west of the treatment building. The drip track area consisted of two parallel rows of narrow-gauge tracks and was approximately 1,000 feet in length and 60 feet wide. Freshly treated ties were allowed to drip onto the underlying track and soils. The depress track, south of the drip track, was used to bring in locomotives and cars to remove the treated ties.

2.2 Hazardous Waste Permits

The State of Montana issued a hazardous waste permit to BNSF in 1988 to allow storage of hazardous waste in an on-site waste pile unit, and to allow treatment of contaminated soil in an on-site land treatment unit. In addition, the Environmental Protection Agency (EPA) issued BNSF a permit under the Hazardous and Solid Waste Amendments to RCRA which requires hazardous waste permitted facilities to conduct facility-wide corrective action. The EPA permit required that BNSF conduct remedial investigation and cleanup of contaminated areas throughout the facility. In 2000, MDEQ obtained oversight for facility-wide corrective action from EPA. Hazardous waste permits (both state and federal) are issued for a ten-year period and may be renewed at the end of that period. The BNSF hazardous waste permit was reissued by MDEQ in 2001 and includes requirements for the operation of a CAMU which consists of a product recovery system and the land treatment unit; continued maintenance of the closed surface impoundment and waste pile; and facility-wide corrective action. The permit also includes requirements to establish an Alternate

Concentration Limit (ACL), a groundwater mixing zone, and land use controls that restrict the use of groundwater.

2.3 Soil Contamination

In 1989, EPA identified 22 potentially contaminated areas which required some degree of investigation and remediation. The areas were designated as Solid Waste Management Units (SWMUs) or Areas of Concern (AOCs). SWMU/AOC closure was completed in 2002 with the excavation of the top 2 feet of SWMU/AOC surface soil containing hazardous constituents with concentrations exceeding an industrial risk-based standard. Excavated areas were backfilled with clean fill and seeded; excavated soil was placed on the LTU for treatment.

2.4 Groundwater Contamination

Subsurface Geology

Geologic studies of the site have defined three laterally continuous stratigraphic units beneath the site. The uppermost unit, Zone I, is a silty soil averaging four feet in thickness. Zone II, a well-graded sand and gravel layer varying between 15 to 60 feet thick, contains a water-table aquifer. Zone II is underlain by Zone III and is a clayey silt combined with fine silty sand. The top of Zone III is considered the base of the water-table aquifer. Groundwater is encountered between 15 and 25 feet below ground surface.

Characteristics of Creosote in the Subsurface

Creosote is a dense non-aqueous phase liquid (DNAPL); when creosote is released to subsurface soils it migrates downward and slightly outward. After reaching the water table, creosote will continue to migrate downward because it has a density slightly greater than water. Since most of the constituents in creosote are essentially insoluble, creosote usually remains as a separate liquid phase (free phase) when it is in contact with groundwater. Additionally, the rate of free phase creosote movement is many times slower than that of water.

The subsurface conditions at the Paradise site have been investigated through extensive groundwater monitoring and on-going corrective action soil characterizations. Monitoring has determined that groundwater has been impacted by creosote constituents in dissolved phase, residual phase, and free phase. BNSF installed alternate municipal water supply wells for the Town of Paradise in 1987. Figure 1 is a map of the dissolved phase and free phase PAH plumes found in the subsurface at the Paradise Site.

Dissolved Phase PAH's

Groundwater data indicate that the dissolved PAH plume fluctuates throughout the year, but generally has not increased in size since the initiation of monitoring in 1986. The observed static extent of the PAH plume and the distribution of dissolved oxygen concentrations suggest that intrinsic biodegradation is occurring in the aquifer. Monitoring wells continue to be sampled at the Paradise Site to ensure dissolved phase PAHs are not increasing in concentrations or migrating off site.

Residual Creosote

As the creosote migrates downward in the subsurface some of it becomes trapped in the soil pore spaces as residual saturation. Creosote at residual saturation will not flow to a recovery well and cannot be removed from the soil pores by groundwater pumping. Residual creosote at the Paradise site is estimated at 1,050,000 gallons.

Free Phase Creosote

Extensive mapping of the top of Zone III formation indicates free phase creosote has collected in localized depressions on the top of this impermeable zone. Any additional movement of free phase on the top of Zone III will tend to be towards these depressions. In 1996, BNSF began removal of free-phase creosote from the groundwater in the former treatment area and the southeast portion of the surface impoundment. Free phase creosote at the Paradise Site is estimated at 94,000 gallons.

2.5 Impacts to the Clark Fork River

Groundwater monitoring and sediment sampling near the Clark Fork River have demonstrated that subsurface contamination does not appear to impact the river.

3.0 REMEDIATION TREATMENT TECHNOLOGY EVALUATION

In 1992, BNSF conducted a Surface Impoundment Corrective Measures Study (SICMS) which extensively evaluated groundwater treatment technologies that could address residual and free phase creosote at the Paradise Site. The SICMS recommended removal of recoverable free phase creosote via pump-and-treat and modification of the Groundwater Protection Standard (GWPS) to risk-based levels through an Alternate Concentration Limit (ACL). Pump-and-treat was installed in 1996 as an interim measure and BNSF submitted an ACL petition in 1992. The ACL petition went through several discussions and further research before being finalized, as explained in section 5.0 of this document. Below is a brief description of each evaluated technology in the SICMS.

3.1 Flushing Technologies

Flushing technologies are used to enhance recovery of residual and free phase creosote in the subsurface. In hot water flushing, the oily waste is mobilized by controlled heating and is displaced to recovery wells by sweeping the oily waste accumulation with hot water. The chemically enhanced flushing methods use injection of a surfactant, alkali, or alcohol, followed by recovery of the contaminant and subsequent flushing of residual additive.

Flushing technologies, regardless of their level of aggressiveness, would leave residual creosote in place in the source zone as a continuing PAH source to groundwater. In addition, the more aggressive and innovative techniques raised the potential risk of increasing the concentration and transport of soluble-phase constituents. The SICMS concluded that hot-water flushing of creosote would require a containment system to ensure complete capture of all mobilized DNAPL and dissolved constituents.

Flushing calculations and simulations found that flushing technologies did not provide any quicker recovery of creosote than biodegradation. Creosote removal through biodegradation is estimated to take 300 years.

3.2 In Situ Bioremediation and Aquifer Aeration

In situ bioremediation is a process for enhancing the growth and activity of aerobic bacteria by controlled introduction and transport of an oxygen source and water-soluble nutrients. Aquifer aeration is similar to in situ bioremediation except that it does not involve the addition of nutrients.

Based on the limited data available for wood preserving sites, the effectiveness of in situ bioremediation and aquifer aeration is difficult to predict. While enhanced in situ bioremediation would be effective in reducing the boundaries of the dissolved phase contaminant plume, it would not remove or reduce the source of contamination. Enhanced in situ bioremediation would only be effective during system operation. If the system was turned off, the plume would return to its steady state condition. Due to the time required to biodegrade residual creosote in the subsurface, long-term operation (>300 years) would be required to maintain reduction of the dissolved phase plume.

3.3 Containment Technologies

Physical containment technologies evaluated included a slurry wall, grout curtain, and sheet piling. These physical containment technologies most likely would require the use of another engineered process, such as recovery wells, to prevent groundwater mounding inside the area enclosed by the barrier. The hydraulic containment technologies evaluated were groundwater recovery and injection wells, and an interceptor trench/french drain system. Hydraulic containment is designed only to prevent further migration of contaminated groundwater with minimal removal of contamination from the source zone.

In general, the SICMS determined that containment technologies were ineffective in reliably containing migration of PAHs, were of excessively large size, and/or were considered unnecessary. Physical containment barriers could not be effectively anchored to the underlying less permeable silt. The uneven surface of the top of the Zone III silt layer and the limited permeability would still potentially allow some dissolved PAHs and/or DNAPL to migrate beneath the barrier. Sheet piles and grout curtains would not be constructable in the cobble-rich gravelly subsurface materials.

Groundwater pumping for containment would be impractical due to the excessively high groundwater volumes that would be produced. Groundwater modeling results indicate that under average groundwater flow conditions the volume of water that must be pumped would be at least 1,008,000 gallons per day.

Based on the above determinations, containment technologies were considered technically impractical.

3.4 Source Removal

Source removal would involve either product recovery operations in the form of pump and treat to remove recoverable creosote, or excavation of source materials from the aquifer.

Pump and Treat

Free phase creosote removal through pump-and-treat is a proven technology that has been implemented at many wood treating sites. Due to the capillary forces in the subsurface and the nature of creosote, the recoverable fraction of the source is estimated to be less than 6% of the total mass of creosote in the subsurface. Resultantly, free phase creosote removal will not have a significant impact on groundwater quality or lessen the estimated 300 years remediation time frame for natural attenuation. However, product recovery ranked high in overall performance and implementability and was retained as part of the proposed groundwater corrective action. A network of product recovery wells have been operating in the surface impoundment since 1996. In the former treatment area, a reciprocating pump was installed in 1996 for removal of free phase product.

Excavation

Removal of source materials would require excavation to depths of 45 to 50 feet below ground surface, the majority of which is below the water table. Site characteristics (groundwater flow direction, velocity, size of material and contaminant characteristics) would determine the method and equipment used for excavation. Groundwater control during excavation would require containment of the excavation areas and dewatering prior to excavation. The SICMS evaluated the use of sheet piles for containment of excavation areas in the surface impoundment and this technology would be applicable to the areas of excavation in the SWMUs. Production wells would be required to dewater the excavated area and the high water yields would require a large water treatment system. On-site thermal treatment of the excavated material would be required due to the high concentration of hazardous constituents. For these reasons excavation was considered technically impractical and was not carried further in the evaluation.

3.5 Summary Of Technology Evaluation

The SICMS concluded that natural attenuation coupled with product recovery was the most viable approach for groundwater remediation at the Paradise site. Based on the evaluations of time frames, the SICMS also determined that approaches using in situ treatment methods did not guarantee groundwater would be treated any faster than by naturally occurring processes.

Restoration of the site groundwater to drinking water quality cannot be accomplished within a reasonable time frame because residual creosote present in the subsurface cannot be entirely removed. Therefore, groundwater restoration is technically infeasible.

4.0 GROUNDWATER REMEDIATION TIME FRAMES AND RECOVERABLE CREOSOTE

Remediation time frames are controlled by three basic considerations: free DNAPL recovery, flushing of residual DNAPL, and biodegradation. When biodegradation was taken into account for all evaluated technologies, the remediation time frames were about 300 years for all potential groundwater corrective action alternatives. This highlights the conclusion that a combination of free phase creosote DNAPL recovery and natural attenuation will achieve the groundwater remediation goals in about the same time frame as any other combination of technologies.

The rate of free DNAPL recovery is controlled by two considerations: the volume of recoverable free DNAPL and the rate of recovery. The contribution of the recoverable DNAPL to the total creosote mass in the subsurface is quite small (2 to 6 percent). The estimated maximum volumes of recoverable creosote at the Paradise Site are 8,500 gallons from the surface impoundment area (out of an estimated 494,000 gallons), and 38,500 gallons from the former treatment area (out of an estimated 650,000 gallons). Actual recoverable volumes may be significantly less due to undulations in the Zone III surface, truncation of the creosote pools, technological/engineering limitations, and the highly viscous nature of the creosote. Therefore, no significant decrease in total remediation time is achieved by removing the recoverable DNAPL in a short time period.

5.0 ALTERNATE CONCENTRATION LIMIT

Alternate Concentration Limits (ACLs) are risk-based groundwater levels that are created when it is impracticable or impossible to achieve the existing groundwater protection standards. Specifically, ACLs are contaminant concentrations that, based on a site specific risk assessment, have been determined to not pose a substantial hazard to human health or environmental receptors (given exposure pathways and other factors). At the Paradise Site, given the nature of creosote, it is technically impractical to achieve the existing groundwater protection standards..

In 1992 BNSF submitted an Alternate Concentration Limit (ACL) Variance Petition to request an ACL using risk-based levels. Based on comments from the MDEQ and EPA, BNSF conducted a human health risk assessment as part of a 1996 supplemental ACL petition. The risk assessment developed allowable exposure concentrations (AECs) for PAHs in groundwater using a residential ingestion exposure scenario. In the 2001 permit reissuance, MDEQ required BNSF to complete the

ACL petition for MDEQ approval. BNSF provided a supplemental ACL petition, which was finalized in 2004.

A network of monitoring wells was then selected to evaluate PAH concentrations in the groundwater with respect to the site-specific AECs. Point of Exposure (POE) monitoring wells were proposed along the boundary of the Site. The POE monitoring wells are the point in which the established AECs cannot be exceeded. Groundwater samples will be taken from the POE wells semi-annually and analyzed to ensure PAH concentrations do not exceed the established AECs. Point of compliance (POC) wells were proposed in locations inside the Paradise Site that have had detectable levels of PAHs and low levels of dissolved oxygen, indicating they are all within the zone where biodegradation is occurring. Groundwater samples will be taken from the POC wells annually and analyzed to ensure PAH concentrations are not showing a statistically significant increase in concentrations. Locations of the POE and POC wells are presented in Figure 2. In addition, the Montana Department of Natural Resources has delineated a controlled groundwater use area to ensure that withdrawals of groundwater do not alter the distribution of dissolved PAHs.

The MDEQ has modified BNSF's permit to include requirements for the ACL. MDEQ is also soliciting public comment at this time for the proposed permit modification language.

6.0 LAND USE CONTROLS

In the proposed permit modification, MDEQ specifies requirements for establishing land use controls to further ensure prevention of potential future exposure to contamination. Required land use controls include compliance with the DNRC Controlled Groundwater Use Area designation, deed restrictions, restrictive covenants, an actual notice to any potential successors of the title in the property, engineering controls, notice to government authority prior to any land transaction, and annual land use control notification to MDEQ.

7.0 PUBLIC PARTICIPATION

In the past, MDEQ and EPA have informed the public of the corrective action activities at the Paradise Site through a variety of outreach activities, including fact sheets and public meetings. The Agencies also have periodically briefed a local citizens group, the Paradise Creosote Monitoring Committee (PCMC), on the status of the corrective action.

MDEQ is seeking input from the community on the selected groundwater remedy described in this SB. MDEQ has set a public comment period from March 22, 2006 through May 5, 2006 to encourage public participation in the remedy selection process. During the public comment period, any interested person may request a public hearing. A request for a public hearing must be in writing and must state the nature of the issues proposed to be raised in the hearing. The MDEQ will provide notice of the public hearing date at least thirty days prior to the hearing.

DEQ will prepare a Response to Comments after reviewing oral and written comments. DEQ will then finalize this Statement of Basis and include both documents in the public record for the site. DEQ will announce the availability of the final Statement of Basis, Final Permit Modification Language, and Response to Comments to the local newspaper and to those on the site mailing list.

The selected remedy will be carried out under BNSF's hazardous waste permit once the permit modification is effective.